1998-99 CATS ASSESSMENT
Open-Response Item Scoring Worksheet

Grade 5—Mathematics

The **academic expectation** addressed by "Temperature Changes" is

2.10 Students understand measurement concepts and use measurement appropriately and accurately.

The **core content** assessed by this item includes

Geometry/Measurement Concepts

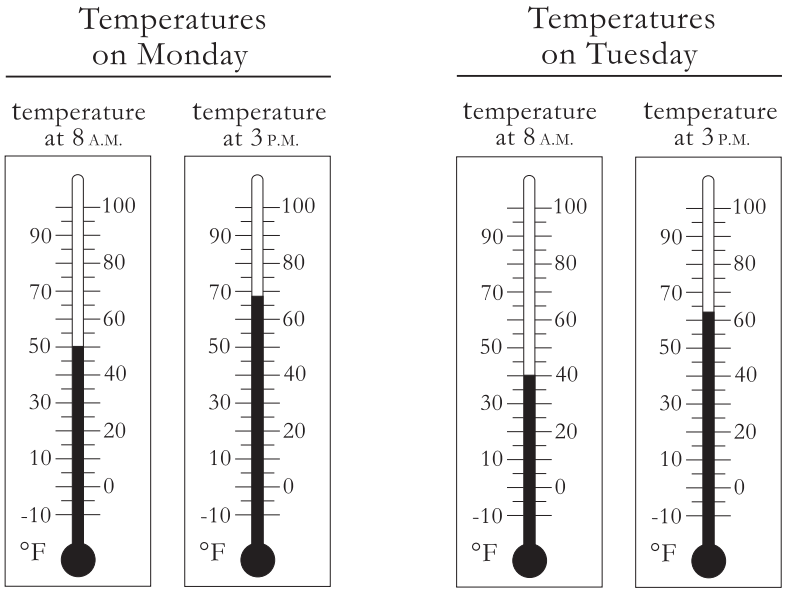
- Students should understand nonstandard and standard units of measurement, English and metric.

Geometry/Measurement Skills

- Students should be able to use standard and nonstandard units to measure length, area, liquid capacity, volume, money, time, temperature, and weight.

Temperature Changes

The thermometers below show the temperatures in degrees Fahrenheit at 8 A.M. and at 3 P.M. on Monday and Tuesday of a week in May.



a. What was the temperature in degrees Fahrenheit on Monday at 8:00 A.M.?

b. What was the temperature in degrees Fahrenheit on Monday at 3:00 P.M.?

c. On which day did the temperature go up the most between 8 A.M. and 3:00 P.M.?

Write how you would explain your answer to a friend.

SCORING GUIDE
Grade 5 Mathematics

Score	Description
4	Student gives correct answers for parts a, b, and c; explanation is clear and complete.
3	Student gives acceptable temperatures for parts a and b; Part c: answers Tuesday; explanation is correct, but possibly vague.
2	Student gives at least **two** acceptable temperatures. **OR** Student correctly finds increase in temperature for at least **one** day. **OR** Student gives correct answer for part c; explanation indicates correct strategy; parts a and/or part b are incorrect or missing.
1	Student shows minimal understanding of temperature.
0	Response is totally incorrect or irrelevant.
Blank	No response.

Correct Answers: Part a: 50°

Part b: 68°

Part c: Tuesday

Acceptable temperatures:

Monday: 8 a.m. — 50°F

3 p.m. — 67° to 69°F

Tuesday: 8 a.m. — 40°F

3 p.m. — 62° to 64°F

Note: Student does not have to use the term “subtraction” in determining temperature.

ANNOTATED STUDENT RESPONSE
Grade 5 Mathematics

Sample 4-Point Response of Student Work

Student Response

a. It was 50°F.

b. It was about 68°F.

c. It went up the most Tuesday. On Monday at 8:00 a.m. the temperature was 50°F. Then at 3:00 o'clock it was about 68°F. It only went up 18°. Then on Tuesday at 8:00 a.m. the temperature was 40°F. At 3 o'clock it was 63°. It went up 23°.

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  68    Monday
- 50    up 18 °
  18

  63    Tuesday
- 40    up 23°
  23
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← Student gives correct answer for parts a and b.

← Student gives correct answer for part c with a clear and complete explanation.

Overall, the student demonstrates a strong understanding of the standard units for measuring temperature and ability to read temperatures by correctly answering all three parts of the item and completely explaining the process used to arrive at the correct answer in part c.

ANNOTATED STUDENT RESPONSE
Grade 5 Mathematics

Sample 4-Point Response of Student Work

Student Response

a. On Monday at 8:00 a.m. the temperature was 50° Fahrenheit.

b. On Monday at 3:00 p.m. the temperature was 68° Fahrenheit.

c. The temperature went up the most on Tuesday. I would explain it to my friend like this: On Monday the temperature was 50° at 8 a.m. and 68° at 3 p.m. The temperature increased 18° And on Tuesday the temperature was 40° at 8 a.m. and 63° at 3 p.m. The temperature increased 23° from 8 a.m. to 3 p.m. So on Tuesday the temperature increased the most.

← Student gives correct answers for parts a and b.

← Student gives a correct answer for part c with a clear and complete explanation.

Overall, the student demonstrates a strong understanding of the standard units for measuring temperature and ability to read temperatures by correctly answering all three parts of the item and completely explaining the process used to arrive at the correct answer in part c.

ANNOTATED STUDENT RESPONSE
Grade 5 Mathematics

Sample 3-Point Response of Student Work

Student Response

a. The temperature on Monday at 8:00 a.m. was 50° Fahrenheit.

b. The temperature on Monday at 3:00 p.m. was 68° Farenheit.

c. On Tuesday. I would show my friend my answer by comparing the graphs it shows. I would compare how far away they are from each other. The reason I could tell this is one is because the 8 a.m. on Tuesday is farther down than the 8 a.m. on Monday. So I subtracted 50 from about 68, which is 18. Well 18 is smaller than 24, so Tuesday would be my answer.

← Student gives correct answers for parts a and b.

← Student give a correct answer for part c but explanation is vague (i.e., does not explain where 24 came from).

Overall, the student demonstrates a good understanding of the standard units for measuring temperature and ability to read temperatures by correctly answering all three parts of the item and partially explaining the process used to arrive at the correct answer in part c.

ANNOTATED STUDENT RESPONSE
Grade 5 Mathematics

Sample 2-Point Response of Student Work

Student Response

a. It is 50°F. on Monday at 8:00 a.m.

b. It is 69°F. on Monday at 3:00 p.m.

c. The temp. went up the most on Monday and I would write this to my friend by saying the temp. went up to 69°F. on Monday at 3:00 p.m.

← Student gives correct answers for parts a and b.

← Student gives an incorrect answer for part c with an incomplete explanation of the process used.

Overall, the student demonstrates some understanding of the standard units for measuring temperature and ability to read temperatures by correctly answering part of the item and providing an incorrect explanation of the process used.

Sample 1-Point Response of Student Work

Student Response

a. At 8:00 a.m. on Monday it was 50°F.

b. At 3:00 p.m. on Monday it was 61°F.

c. The day the temperature went up on a Monday at 3:00 p.m. The temperature was 61°F. I would tall won't the temperature was on each day.

← Student gives a correct answer for part a.

← Student gives an incorrect answer for part b.

← Student gives an incorrect answer and an incomplete explanation of the process used for part c.

Overall, the student demonstrates little understanding of the standard units for measuring temperature and some ability to read temperatures by correctly answering only one out of the three parts and giving an incomplete explanation of the process used.

INSTRUCTIONAL STRATEGIES
Grade 5 Mathematics

The open-response item **"Temperature Changes"** assesses (1) students' conceptual understanding of temperature as a form of measurement, and (2) students' ability to read a temperature scale on a Fahrenheit thermometer and compare it mathematically with a different measurement on a second thermometer. The instructional strategies below present ideas for helping students explore and master these concepts and skills.

Using both real thermometers and pictorial representations of thermometers (pictures in textbooks, photocopies, drawings), review concepts related to measuring temperature such as reading scales of different kinds and different measurement devices and interpolating measurements between marked and unmarked scale divisions on measurement instruments. In addition, students should understand how to use subtraction and addition calculations to compare temperature (and other) measurements.

Provide students with a variety of opportunities to use and compare temperature measurements in real contexts during mathematics and science investigations, and encourage the routine use of thermometers (and other measurement instruments). In addition to reading temperature scales, students should be encouraged to interpret and compare the scales of many types of measurement instruments.

Provide opportunities for students to work individually, in pairs, in groups, and/or as a class to complete (with teacher instruction, support and guidance) any or all of the following activities:

- Read and interpret scales of a variety of measurement devices when taking linear, volume, temperature, and weight measurements.
- Regularly use rulers, yard/meter sticks, tape measures, measuring cups, rain gauges, graduated cylinders, digital and analog weight scales, etc., in science and mathematics classes.
- Use both Fahrenheit and Celsius thermometers to compare and understand the differences in their scales and intended uses.
- Interpret and compare scales of thermometers (and other measurement instruments) from pictorial representations such as photocopies and textbook pictures.
- Discuss how scales of thermometers, rulers, graphs, and time-lines are related, and why scales with different divisions are used in different contexts or for different purposes.
- Practice interpolation of scales (determining measurements *between* the numbers shown on scales) of different types with different divisions and explore the role of estimation and approximation in measurement.
- Solve problems that require two or more measurements with the same device (e.g., a Fahrenheit thermometer) and determine the difference(s) between readings using computation.